Second Language Research 1, 2 1985

Second Language Research

Volume 1, Number 2, December 1985

Editors: J. N. Pankhurst and M.A. Sharwood Smith
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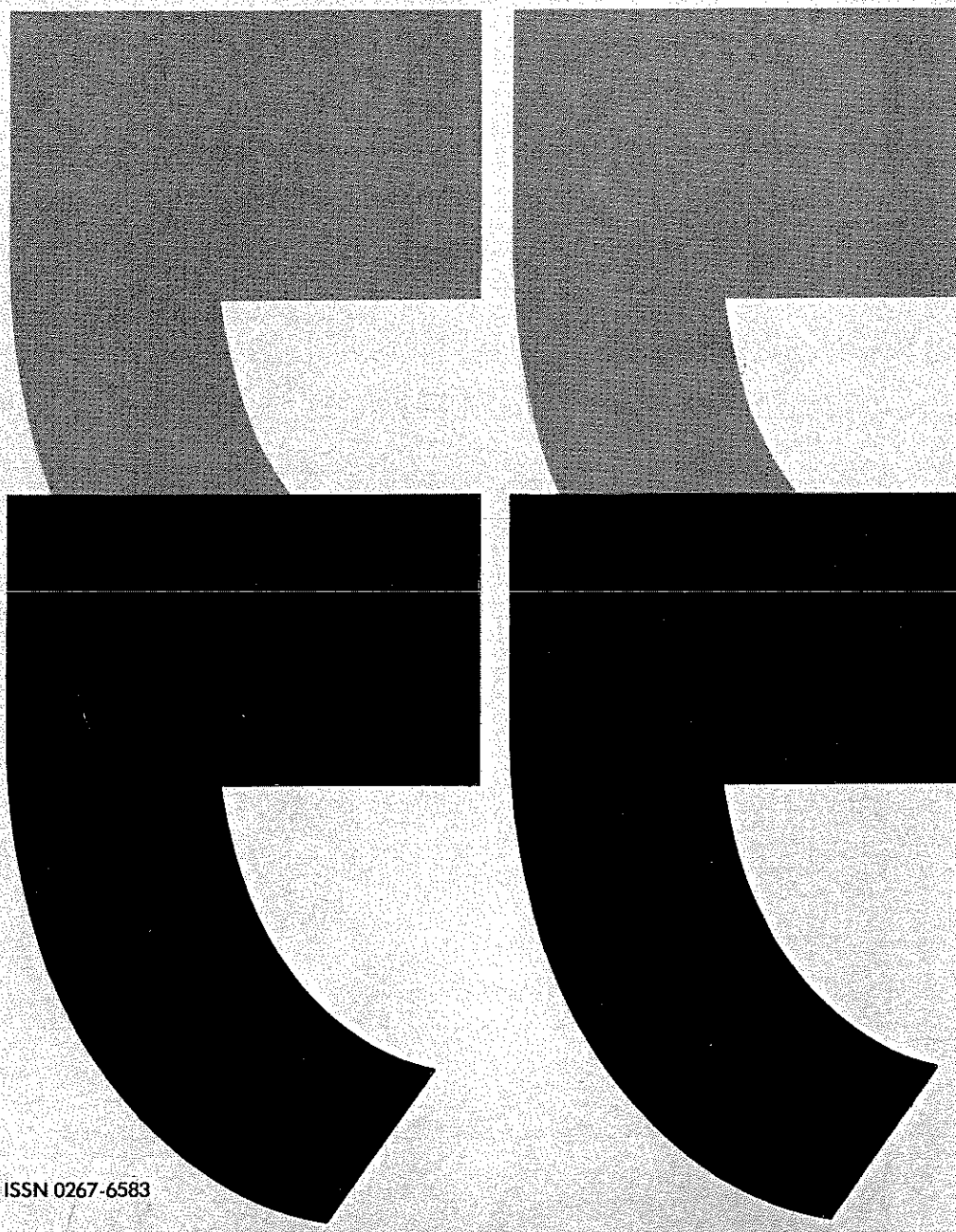

ISSN 0267-6583

Head-initial/head-final parameter in adult Chinese L2 acquisition of English[1]

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In this study, we investigate the role of the head-initial/head-final parameter in adult second language (L2) acquisition of English. Sixty Chinese speaking adults were tested in their elicited production of complex sentences which involved pre- and postposed adverbial subordinate clauses both with and without pronoun anaphors. Results obtained in this study match those reported earlier for Japanese speakers learning English (Flynn, 1981; 1983a; 1983b; 1984; in press). Both Japanese and Chinese are head-final languages (Kuno, 1973; Huang, 1982). Findings are used to argue for the role of the head-initial/head-final parameter in adult L2 acquisition of pronoun anaphora. They are also used to argue for a model of grammar in which parameters associated with head-direction are differentiated from parameters associated with word order (Travis, 1983; 1984). Results also provide additional empirical support for the parameter setting model of L2 acquisition currently proposed by Flynn (1983a; 1983b, in press; forthcoming).

In this paper we present a selected set of results from an experimental study which investigated adult Chinese speakers' acquisition of English complex sentences which varied in pre- and postposing of the subordinate clause (sentences in (1) and (2)) and in pronoun direction (sentences in (2)).

1) a) When the man saw the dean, the provost fainted.
   b) The provost fainted when the man saw the dean.

2) a) When he saw the dean, the man fainted.
   b) The man fainted when he saw the dean.

We compare results obtained from this study with those reported earlier for Japanese speakers in their acquisition of these same sentence structures in English. We will show that patterns of elicited production results for the Chinese speakers match those of the adult Japanese speakers. This predicted replication is argued to reflect two facts: 1) in terms of X-bar theory[2], Chinese and Japanese are head-

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final (Kuno, 1973; Huang, 1982; Travis, 1983; 1984) and, 2) for Japanese and Chinese speakers, as for first language (L1) learners (Lust, 1981; 1983; Lust and Mangione, 1983), this structural property of head-direction has a bearing on second language (L2) acquisition of grammatical anaphora. The results reported in this paper are argued to provide empirical support for a model of grammar in which parameters associated with head-direction configurationality are differentiated from parameters associated with surface structure word order (Travis, 1983; 1984; Huang, 1982). Chinese is argued to be SVO and Japanese is argued to be SOV. In addition, these results are used to provide empirical support for the parameter setting model of L2 acquisition proposed by Flynn (1983a; 1983b; in press; forthcoming).

I Background

In the parameter setting model developed by Flynn (1983a; 1983b; in press; forthcoming), adult L2 learners are argued to use principles of syntactic organization isolated in L1 acquisition in the construction of the L2 grammar. Where principles involve parameters, L2 learners from early stages of acquisition recognize differences in the values of these parameters between the L1 and L2. In cases in which the L1 and L2 match, acquisition is facilitated and is comparable to that for L1 acquisition. In cases in which the L1 and the L2 values differ, L2 acquisition is disrupted as learners must and do 'revise'[3] L1 values to cohere with the L2 grammar.

Empirical evidence in support of this model was derived from several studies which investigated the role of the head-initial/head-final parameter[4] in Spanish and Japanese speakers' acquisition of grammatical anaphora in English. English and Spanish are head-initial as exemplified in (3)–(6) for relative clauses and adverbial clauses in these languages (see discussion in Huang, 1982 with regard to establishing substantive head direction for a language). Japanese is head-final as shown in (7) and (8).

English:
3) [The child [who is eating rice]] is crying.

4) [The child drank the milk [after he ate the rice.]]

Spanish:
5) [El niño [que come arroz]] llora.
'The child who eats rice cries'

6) [El niño bebió la leche [despues de comer el arroz.]]
'The child drank the milk after (to) eat the rice.'

Japanese:
7) [[Go han-o tabete-iru] ko-ga] naite-imasu
'Rice-obj. eating is child-subj. crying is'

8) [[Kodomo-ga gohan-o tabete kara] okasan-wa sooji-shita]
'Child-subj. rice-obj. eating after mother TOP cleaned up.'
After the child ate the rice, the mother cleaned up.

In these initial studies, three levels of adult Spanish and Japanese speakers learning English as a second language (ESL) were tested in both their production and comprehension of complex sentences such as those exemplified in (1) and (2) above and repeated here.

1) a) When the man saw the dean, the provost fainted.
b) The provost fainted when the man saw the dean.

2) a) When he saw the dean, the man fainted.
b) The man fainted when he saw the dean.

These two sentence structures varied in terms of pre- and postposing of an adverbial subordinate *when* clause, preposed in (1a) and (2a), postposed in (1b) and 2b). In addition, one half of these sentences involved a pronoun anaphor in *subject* position of the subordinate clause. Direction of anaphora varied with the pre- and postposing of the subordinate clauses, backwards in (2a) and forward in (2b).

As shown in Figures 1 and 2, sentences with postposed clauses (head [S] precedes the adjunct [S'], correspond to the dominant head-initial structure of English and Spanish; sentences with preposed clauses (adjunct [S'] precedes head [S]) correspond to the predominant head-final configuration of Japanese[5].

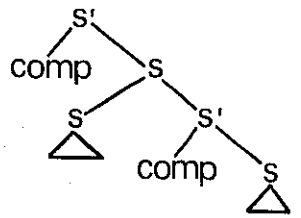

Figure 1

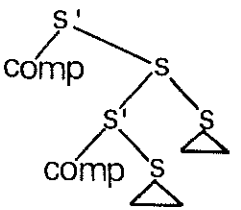

Figure 2

Results of the elicited imitation tests[6] with these two groups of language learners revealed two important findings. First, results for the Spanish speakers (L1 = L2 in head-initialness) matched those for young children learning English as their L1 English (Lust, 1981; 1983; forthcoming). That is, results for these L1 learners indicated a significant preference for sentences such as in (2b), in which the antecedent preceded the pronoun. Similarly, these sentences rather than the sentences in (2a) in which the pronoun preceded the antecedent (backward anaphora), were also significantly easier for the Spanish Ss to imitate.

Second, also as hypothesized, the pattern of results for the Japanese (L1≠L2 in head-direction) did not match Spanish L2 learners of English or English L1 learners. Specifically, there was no forward directionality preference with sentences with either forward or backward pronoun anaphora. That is, sentences in (2a) were not significantly easier to imitate than sentences in (2b). However, critical to the parameter-setting model proposed, results on imitation of the sentences in (1) and (2) indicated that the Japanese did not simply fare worse than the Spanish speakers because of the mismatch in head-direction between the L1 and the L2. Rather results suggested that the Japanese learners were attempting to organize the L2 grammar around the head-initial configuration of English. At the advanced level, Japanese speakers found sentences in (1b) (head-intial: postposed clauses) to be significantly easier to imitate than sentences such as in (1a) (head-final: preposed clauses). This finding, was used to argue that Japanese Ss at this level had reset the value of the L1 head-initial/head-final parameter to cohere with the L2 (see Note 3). This result suggests that this structural parameter is now available as a guiding principle in the acquisition of other aspects of the L2 grammar, namely grammatical anaphora for the Japanese Ss.

From this initial set of results (and others, 1983a; 1984; in press; forthcoming; submitted a;b) Flynn argued for the relevance of a parameter setting model of Universal Grammar (UG) (Chomsky, 1981; 1982; 1984; forthcoming) and for the psychological reality of the specific principle investigated, the head-initial/head-final parameter (see Notes 2 and 5). It is with this last claim that this paper is concerned.

II Focus of this paper

Spanish and English match in ways other than just head-direction.

And, Japanese differs from English and Spanish in ways other than just head-direction. For example, the basic word order of English and Spanish is SVO, as shown in sentences (9) and (10), although Spanish allows more permutation in word order than English (see discussion in e.g. Jaeggli, 1980; Torrego, 1981a; 1981b; 1981c; 1984; Suñer, 1982 for properties of Spanish).

SVO word order:
English:
(9) John hit Mary.

Spanish:
(10) Juan pegó a María.

Japanese, on the other hand, is SOV as shown in sentence (11) (see discussion in Kuno, 1973; Saito, 1985; Farmer, 1980; for properties associated with Japanese).

SOV word order:
Japanese:
11) John-ga Mary-o but-ta.
nominative particle accusative particle hit-past.
(from Kuno, 1973: 3)

Given this difference alone, one alternative explanation for the results briefly summarized above is that a match or mismatch in word order or properties associated with word order (see for example, Travis, 1983; 1984) rather than a match or mismatch in head-direction between the L1 and L2 could account for the earlier reported patterns of acquisition for the Japanese and the Spanish Ss. Thus, in order to establish whether our original account, which was based on differences in head-direction between the L1 and the L2, rather than an explanation based on differences in word order between the L1 and the L2, could provide a full and coherent explanation of these results, we extended this original study to an investigation of a third group of adults learning ESL, Chinese speakers.

III Facts about Chinese

Chinese was chosen for basically two reasons. Chinese matches English and Spanish in its basic word order, SVO (Lii, 1975; Li and Thompson, 1975; Chao, 1968; Mangione, 1982; Huang, 1982; Travis, 1984) as shown in sentences (12) and (13).

SVO word order:

12) Zhangsan zuotian zai xuexiao kanjian-le Lisi.
Zhangsan yesterday at school see-asp. Lisi.
'Zhangsan saw Lisi at school yesterday.'

13) Ta zai xueixiao hen gaoxing zheijian shi.
He at school very happy this matter.
'He was very happy about this matter at school' (Huang, 1982: 26).

However, unlike English, but like Japanese, Chinese is substantively head-final (Huang, 1982). That is, modifiers of the noun, the verb, and the adjective precede their heads. This includes relative clauses, adverb clauses, etc. as shown in sentences (14) and (15)[7].

Chinese:

14) [[Nà-ge zhèn zài chī fàn de]xiao hái zi] zài kū.
'That is eating rice rel. little child is crying.'
The child who is eating rice is crying.

15) [[Dāng Mǎli dǎsǒ fángzi-de shíhou]māma huíái-le]
While Mary cleaned house-rel. when mother came back-asp.
'While Mary was cleaning the house, mother came back'
(from Lust and Mangione, 1983).

Chinese, thus, poses a counterexample to Greenberg's word order universals schema. Within Greenberg's framework, if a language has prenominal relative clauses then it should have postpositions. Chinese has prenominal relative clauses but it has prepositions. In addition, because modifiers of the noun, verb and adjective precede their heads, this would predict that Chinese should be SOV. Chinese as we saw is SVO. The mixed nature of Chinese, as Huang notes, has led to a debate with regard to whether or not Chinese might underlyingly be SOV and be transformationally related to SVO order. This suggestion was made by Tai (1973). Huang claims that such a formulation is unnecessary. The mixed nature of Chinese, he claims, can be accounted for in terms of an X-bar theory within which languages 'may parameterize on both the type and the level of category' (p.40). As discussed in more detail in Note 7, Huang would claim that the VP, AP and PP in Chinese require a head-final rule at the highest levels of X-bar expansion but a head-initial rule for these categories at the lowest levels of expansion.

Travis (1984) in contrast to Huang claims that Chinese is head-final at all levels of X-bar expansion, with the exception of PPs. Apparent contrasts in deep structure head-direction and surface structure word order are accounted for in Travis' account through the interaction of two other independent parameters, direction of θ-role assignment and direction of case assignment (see Koopman, forthcoming, for a slightly different approach). For example, subcategorized NPs (i.e. thematically dependent elements) may appear after the verb in Chinese because they must receive the θ-role from the verb. The value of the θ-direction parameter in this case would be set in a rightwards direction. For the purposes of this paper, the important point to extract from this discussion, regardless of the final account invoked to explain these differences, is that word order and head-direction are related but independent of each other in languages.

One final point, Chinese also allows, as in Japanese and Spanish, both forward and backward pronoun anaphora in sentence environments such as in (1) and (2) above.

IV Experimental hypotheses

For this study we hypothesized that if on a test of the same sentence structures used in our original studies, results for the Chinese were comparable to those for Japanese then this would provide strong empirical support for the role of the head-direction parameter in L2 acquisition of pronoun anaphora. If this is the case we would expect to find evidence which demonstrates that these L2 learners are sensitive to differences between the head-initial/head-final configuration of the L1 and the L2, and that they were able to reset the value of the parameter for this structural principle to match the L2. We would also expect to find in this case evidence of the fact that these L2 learners consulted the structural configuration established by the head parameter in the acquisition of pronoun anaphora. However, if the results initially isolated with the Spanish and Japanese Ss were predominantly due to differences and similarities associated with surface word order between the L1 and the L2, we would expect to find the significant preference for forward pronoun anaphora in the Chinese data that we found in both L1 acquisition of English and Spanish L2 acquisition of English. As stated above, Chinese, Spanish and English all match in their SVO word orders. As a test of these hypotheses we conducted the following experimental test with adult Chinese speakers learning ESL.

V Methodology

In order to insure comparability across the various studies, the design and methodology of this study matched that of our previous ones (see e.g. Flynn, 1983a; forthcoming). In this study we tested 60 adult

speakers of Chinese learning ESL in their production and comprehension of complex sentences such as those exemplified in (1) and (2) and as instantiated in (16) and (17) below.

The mean age for the Ss was 34;00 yrs which was comparable to that of the Japanese ($N = 53$) 30;00 yrs in our previous work. All Ss were administered the same ESL test as in our other studies, the grammar and listening comprehension subtests of The Placement Test (University of Michigan). Based on the results of these two subtests, Ss were placed into one of three levels of ESL competence. These results are shown in (15). Results for the Chinese Ss both overall and at each level are comparable to those for Japanese.

15) English as a Second Language Proficiency Level Placement Scores: (Score Range 0–50) (n = number of Ss; M = mean)

Group	*Beginning*		*Intermediate*		*Advanced*		*Overall*	
	n	*M*	*n*	*M*	*n*	*M*	*n*	*M*
Chinese	11	14.3	20	31.0	29	43.8	60	29.7
Japanese	7	20.3	25	30.8	21	42.5	53	31.2
Overall	18	17.3	45	30.9	50	43.15	113	30.5

VI Experimental test

All Ss were then tested by a standardized elicited imitation task on the stimulus sentences shown in (16) and (17). These sentences are identical to those administered in the previous studies. Sentences varied in pre- and postposing of the subordinate clause, preposed in (16a) and (17a), postposed in (16b) and (17b). Use of these two sentence structures in our experimental design allowed us to investigate the role of structural parameters independent of their role in the acquisition of grammatical anaphora. In addition, sentences in (17) varied in direction of pronoun anaphora, backward in (17a) and forward in (17b).

VII Stimulus sentences

16) No anaphora
   a) Preposed: When the actor finished the book, the woman called the professor.
   b) Postposed: The worker called the owner when the engineer finished the plans.

17) Pronoun Anaphora
   a) Backward/Preposed: When he delivered the message, the actor questioned the lawyer.
   b) Forward/Postposed: The man answered the boss when he installed the television.

In the elicited production test used in this study, the experimenter orally presented, one by one, a series of randomized experimental sentences to the S who was asked to repeat each sentence as presented. These production tests principally evaluate a learner's structural knowledge of the L2. The basic assumption which underlies the experimental use of this test is that the active repetition of the stimulus reflects input of the sentence to both the S's comprehension and production systems. The grammatical structure of the stimulus sentence is relevant to this processing (see Flynn, 1983a; submitted a; Gallimore and Tharp, 1981). All elicited productions were tape recorded. Responses were transcribed by the experimenter as soon as possible after testing (see Flynn, 1983a; forthcoming for complete scoring details).

Prior to the experimental sessions all Ss were given bilingual lists of the lexical items used in the production tests to study before administration of the actual experimental test. At the experimental session, testing did not begin until each S had demonstrated 100 per cent comprehension of the words to be used. Controlling for Ss' knowledge of the words used in the testing insured that the results obtained were due to the differences in the structural factors manipulated and not due to lack of knowledge of the English lexicon.

All the stimulus sentences were equalized in syllable length (15 syllables) and approximately in word length (10 words). To disallow easy pragmatic solution, or astructural decoding of these sentences, conventional pairings of agent and patient were avoided. Complete sentence batteries are given in Appendix I.

VIII Results

Overall, patterns of results for the Chinese Ss match those found for Japanese Ss learning ESL[8]. The results confirm the role of the head-direction configuration in the acquisition of these complex sentences in English.

1 Amount correct

In terms of amount correct this can be seen in two ways. First, as shown in Table 1 , results on successful imitation for pre- and postposed sentences which did not involve any pronoun anaphora (sentences in (16a) and (16b) indicated no significant difference in Ss' productions at the beginning and intermediate levels. However, at

Table 1

(score range: 0–3)	Level means		
No anaphora			
Chinese			
	Preposed	Postposed	Overall
Beginning	.09	.18	.14
Intermediate	0.65	.50	.58
Advanced	1.21	1.83	1.52
Overall	.65	.83	.75
Japanese			
	Preposed	Postposed	Overall
Beginning	.00	.00	.00
Intermediate	.24	.12	.18
Advanced	.38	1.05	.72
Overall	.21	.39	.30
Pronoun anaphora			
Chinese			
	Backward/Preposed	Forward/Postposed	Overall
Beginning	.00	.18	.09
Intermediate	.40	.50	.45
Advanced	1.66	1.86	1.76
Overall	.68	.85	.76
Japanese			
	Backward/Preposed	Forward/Postposed	Overall
Beginning	.00	.14	.07
Intermediate	.36	.44	.40
Advanced	1.14	1.24	1.19
Overall	.50	.61	.55

the advanced level, Chinese Ss found sentences with postposed clauses significantly easier to imitate than sentences with preposed clauses ($F(1,28) = 8{,}06$, $p = .0083$). This is also illustrated in Figure 3.

Second, results on amount correct on sentences with pre- and

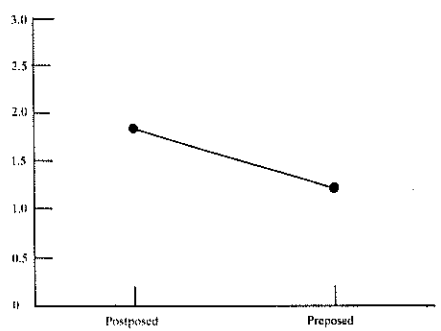

Figure 3 Advanced level; Chinese: mean amount correct (Postposed vs Preposed/No anaphora)

postposed clauses, which did involve pronoun anaphors (sentences (17a) and (17b), in contrast to those with no anaphora, indicate no significant difference between sentences with forward or backward pronoun anaphora at any level.

These two results suggest, as argued for the Japanese, that the Chinese Ss do not simply map from the L1 onto the L2. If this were the case we would have expected a significant preference for preposed clauses at early stages as these structures match the L1 head configuration. In addition, when a preference is shown for a particular structural configuration (the advanced level preference for postposed clauses), it is for the L2 dominance structure. This suggests that the learners are able to work out the structure of the L2 and 'revise' (see Note 3) L1 parametric values for this principle. This finding cannot be explained in terms of an advanced competence in English alone. If this were the case, we would have expected to obtain a similar result for sentences which do involve pronoun anaphors. This finding instead provides additional evidence that L2 learners need to establish the basic dominance configuration for the L2 they are learning, that they are able to do this, and where there is a mismatch, they must reset values to cohere with the L2. Finally, the fact that no preference is found for either forward or backward anaphora, as was isolated for Spanish, also supports our claim with regard to the role of this abstract head configuration in the acquisition of pronoun anaphora. Since it appears that L2 learners hypotheses about anaphora are constrained by the basic dominance structure investigated in this study, L2 learners need to first establish this configuration for the L2 before they are able to consult this structure in setting up anaphora relations. As is well known, construal of anaphora relies upon sentence structure in order to establish the domains within which two NPs may be construed as coreferential (Wasow, 1972; Reinhart, 1976). These results reported here indicate one way in which L2 learners, as L1 learners begin to construct these domains in acquisition. By using the basic dominance configuration determined by the head-initial/head-final parameter to constrain initial hypotheses about anaphora, the possibility of an anaphor dominating its antecedent is ruled out in early acquisition (see more detailed discussion in Lust, 1982; Lust and Mangione, 1983; Flynn, forthcoming).

2 Error analyses

These above conclusions are also supported by the kinds of errors the

Table 2

Error analyses
Conversion to coordination (with no pronoun anaphora)
(% of error)

Chinese

	Preposed	Postposed	Overall
Beginning	16%	16%	16%
Intermediate	20%	13%	17%
Advanced	6%	6%	6%
Overall	14%	12%	13%

Japanese

	Preposed	Postposed	Overall
Beginning	19%	33%	26%
Intermediate	33%	36%	35%
Advanced	35%	39%	37%
Overall	32%	37%	34%

Examples of conversion to coordination

Chinese

Stimulus: The boss informed the owner when the engineer finished the plans.
Response: The boss informed the owner; the boss finished the plans.

Japanese

Stimulus: The worker called the owner when the engineer finished the plans.
Response: Worker called owner; engineer finished the plans.

Chinese Ss made on these sentences, as shown in Tables 3 and 4. First, error analyses on sentences without pronoun anaphors (sentence in (16)) indicate that the Chinese Ss, like the Japanese Ss, had difficulty with embedding in general. Conversion to coordination[9], for example, as shown in sentences (18) and (19), accounts for a large proportion of the errors made on these sentences (overall, Chinese: 13 per cent; Japanese: 35 per cent) (see Note 7). In contrast to the results for both of these groups, this error accounted for a very small percentage of the total error for the Spanish Ss, 3.5 per cent overall.

Conversion to coordination

18) Stimulus: The boss informed the owner when the engineer finished the plans.
Response: The boss informed the owner; the boss finished the plans.

19) Stimulus: The worker called the owner when the engineer finished the plans.
Response: Worker called owner; engineer finished the plans.

Secondly, results indicate that the Chinese Ss, as the Japanese Ss, structurally differentiated the two types of sentences tested. These

Table 3

Conversion to coordination error
Redundancy in subject
% of conversion

Chinese	Preposed	Postposed	Overall
Beginning	80%	0%	40%
Intermediate	11%	0%	6%
Advanced	33%	0%	17%
Overall	35%	0%	18%
Japanese			
Beginning	75%	14%	45%
Intermediate	44%	4%	24%
Advanced	21%	13%	17%
Overall	37%	12%	25%

Examples of conversions
Stimulus: When he delivered the message, the man questioned the lawyer.
Response: The man delivered the message and the man questioned the lawyer.

Stimulus: The doctor called the professor, when he prepared the breakfast.
Response: The doctor called the professor and the doctor prepared the breakfast.

Table 4

Mean amount of anaphora error
(with pronoun anaphora)
(score range: 0–3)

Chinese

	Backward/Preposed	Forward/Postposed	Overall
Beginning	.18	.27	.23
Intermediate	.55	.10	.33
Advanced	.24	.17	.21
Overall	.32	.18	.25

Japanese

	Backward/Preposed	Forward/Postposed	Overall
Beginning	.14	.14	.14
Intermediate	.84	.32	.58
Advanced	.71	.24	.48
Overall	.56	.23	.40

Examples of anaphora errors

Chinese

Stimulus: When he delivered the message, the man questioned the lawyer.
Response: When you de finish de message, de lawyer call de m . . . call de lawyer.

Japanese

Stimulus: When he prepared the breakfast, the doctor called the professor.
Response: When the prof . . . When the professor have the breakfast, the doctor have the breakfast.

results are important in that they provide additional evidence for our claim that Ss from early stages of acquisition are sensitive to structural differences between the L1 and the L2. This is a necessary prerequisite if we are to argue that L2 learners are capable of reworking L1 parametric values to cohere with the L2. As shown in Table 3, the Chinese Ss converted sentences with preposed clauses to coordinate sentence structures which involved some type of redundancy in the subject[10] more often than they did sentences which involved postposed clauses (overall: preposed clauses 35 per cent; postposed 0 per cent). This is exemplified in sentence (20). A similar pattern also holds for the Japanese (overall: preposed 37 per cent; postposed 12 per cent).

Conversion to coordination: redundancy in the subject

20) Stimulus: When he delivered the message, the man questioned the lawyer.
Response: The man delivered the message and the man questioned the lawyer.

Another way this sensitivity can be seen is in terms of the differential amount of anaphora error[11] the Chinese Ss made on the two sentence structures. There is more anaphora error on the backward anaphora structures (overall mean: .32) than on the forward anaphora structures (overall mean: .18). This pattern also holds of the Japanese Ss as shown in Table 3 (Japanese, backward: .56, forward: .23). An example of this error type is shown in sentence (21).

Anaphora error:

21) Stimulus: When he delivered the message, the man questioned the lawyer.
Response: When you de finish the message, de lawyer call de m . . call de lawyer.

Thus, the results of these error analyses indicate embedding as a source of difficulty for the Chinese, a finding we would predict given the nature of the parameter tested. Subordinating one clause to another involves both a linear ordering and a hierarchical structuring of a head in relation to a non-head element (in this case an adjunct clause). For the Chinese, as for the Japanese, this is problematic due to the mismatch in head-direction between the L1 and the L2. The error results also indicate sensitivity to structural differences between the L1 and the L2.

In summary, patterns of results of production on these sentence structures matched those for Japanese Ss. This was demonstrated both in terms of patterns of amount correct – preference for postposed clauses with no pronoun anaphora at the advanced level – and in patterns of errors made – e.g. problems with embedding,

differentiation of structural properties of the sentence structures tested. And, significantly, results for the Chinese Ss, as for the Japanese Ss, did not indicate any preference for forward or backward anaphora in terms of amount correct. Sentences with forward anaphors were not significantly easier for the Ss to imitate than were sentences with backward, although the pattern of the Chinese anaphora error suggests that the Chinese are developing a forward directionality preference similar to that shown by the Spanish. However, as argued for the Japanese (Flynn, in press) this forward directionality effect alone did not seem to significantly help the Chinese Ss in acquisition as they are unable over the ESL levels tested here to very successfully imitate postposed sentence structures both with and without forward pronoun anaphora. These results along with patterns for amount correct for postposed sentence structures do, however, support our claim that Chinese Ss are sensitive to structural properties of the L2 and are able to rework structural parameters to cohere with the L2 values. .

In conclusion, we had hypothesized that if patterns found for the Chinese Ss were comparable to those found previously for the Japanese, then this would confirm our original claim with regard to the role of the head-initial/head-final parameter in acquisition of anaphora. Japanese and Chinese are head-final and they both differ from English and Spanish along this dimension.

If we found that patterns of results for the Chinese were comparable to those for the Spanish, this would have suggested that our original claim *vis à vis* the head parameter was incorrect. Such results would have suggested instead that the patterns found were perhaps more strongly due to effects associated with a match in word order properties between the L1 and the L2 (see Notes 3–4). Results reported here did not support this hypothesis (see Note 7 and discussion in Rutherford, 1983 for a related finding; see discussion in Jansen *et al.*, 1981; Appel, 1984 for a contrasting view).

The results reported here confirm our initial findings with regard to the structure dependence of L2 acquisition (cf. Clahsen, 1984 for an alternative perspective). They also confirm our earlier reported claim with regard to L2 learners' early sensitivities to a head-initial/head-final configuration in acquisition of pronoun anaphora (cf. Taylor, 1975; Appel, 1984 for a discussion of early sensitivities). Only the parameter associated with the abstract property of dominance configuration (head-initial/head-final) could provide the unifying explanation necessary for these findings.

IX Conclusions and discussion

These results have implications for both theories of L2 acquisition and for a theory of Universal Grammar (UG).

With regard to L2 acquisition, the data presented in this paper provides important additional support for the parameter-setting model of L2 acquisition proposed by Flynn (e.g. 1983a; 1983b; forthcoming) (cf. Liceras, 1981; 1983; White, 1985). This model, as briefly outlined above, allows one to account for both the role of the L1 experience in L2 acquisition – a perspective originally captured by Contrastive Analysis (Lado, 1957; Fisiak, 1983) and the role of principles of acquisition independent of this experience (Dulay and Burt, 1974). In this paper we have shown both how Chinese speakers use the principle of head-direction isolated in L1 acquisition in L2 acquisition. We have also demonstrated the role of the L1 experience in this model.

More generally, the results reported here and elsewhere (Flynn, 1983a; 1983b; forthcoming) indicate that L2 acquisition cannot be explained in terms of a set of astructural processing strategies which an L2 learner applies in learning the new target language. Work which relies on, for example, Slobin's Operating Principles (Slobin, 1973). (e.g. 'pay attention to the ends of words' [Operating Principle A, p.191]) would fail to account for the structure dependence of the L2 acquisition process and would fail to capture the abstract generalizations about L2 learning discussed in this paper. Work which also assumes that the L2 learners initially attempt to blindly map their L1s onto the L2s (cf. Kellerman, 1983 for a related discussion) would also fail to account for the structural sensitivities of the L2 learning process isolated here.

These L2 acquisition results can only be understood and explained within a framework that specifies that principles of UG which determine L1 aquisition also determine L2 acquisition. When these principles involve parameters, L2 learners are able to deduce the L2 value. If the L1 and the L2 do not match in parametric values, L2 learners are able to calibrate these parameters to cohere with the values for the L2 grammar (see Note 3).

With regard to theories of Universal Grammar, the findings reported here are important in several ways. We have confirmed findings reported earlier for the role of a structural parameter isolated in L1 acquisition in L2 acquisition. While it is not logically necessary that a theory of UG should characterize L2 acquisition (see discussion in Flynn, 1983a; forthcoming; Comrie, 1984; Cooke, 1984) to the degree that we find the same results in both L1 and L2 acquisition this provides strong empirical validation for the role of a theory of UG in L2 acquisition (as a theory of the initial competence). It also provides empirical validation for the specific principle investigated; that is, central to a parameter-setting formulation of a theory of UG is the claim that there are a number of differential parameters to be set in the acquisition of language. Thus, in support of such models we would expect empirical data to verify these claims. Data presented here, along with earlier reported results from both L1 and L2 acquisition, confirm this essential premise of a parameter setting model. In addition, to the extent that there are possibilities for configurational rearrangement across languages, head-direction seems to be one way in which this rearrangement is instantiated. Through manipulation of this structural property in our design, we have provided verification for this as a parameter of UG. Results also provide support for a model of language, in which a head-direction configuration makes a contribution to the grammar independent of properties associated with word order (see Notes 2–4). That is to say, setting of the head-initial/head-final parameter, in this case for the NP, has a set of consequences for acquisition independent of consequences which may fall out from setting parameters associated with word order (e.g. direction of case or θ assignment) for a particular value. Though the setting of these parameters may overlap, for example in Japanese or English, the Chinese data indicate here that such parameters are independent and will make distinct contributions in terms of their deductive consequences for the rest of the grammar and for acquisition.

X Notes

[1] This is a revised version of a paper entitled 'Parameter setting Model of L2 Acquisition: evidence from Spanish, Japanese and Chinese' presented at LARS, Utrecht, August 1984.

The authors wish to thank Wayne O'Neil, Jack Carroll, Lisa Travis, Diane Massam, Barbara Lust, Bill Rutherford, Ken Hale, Jim Gair, Michele Sigler, the LARS participants and two anonymous reviewers for comments and critical discussion on various sections of this paper throughout its preparation. We would also like to thank all the Chinese speaking ESL students who so willingly and generously gave of their time in order to

participate in this project. Without these individuals there would have been no study. We also owe a debt of gratitude to the teachers at the Chinese American Civic Association (CACA), Boston, Massachusetts, for allowing us to work with the students in their classes. Special thanks are also owed to Sandro Massaro and Cindy Gimbert, the directors of the English language center at CACA.

This study was made possible in part from a research grant received from MIT, School of Humanities and Social Science.

[2] We take X-bar theory, a schema which applies at D-structure, to abstractly specify dominance in head-complement relations (see discussion in Stowell, 1981).

The basic form of the X-bar rule template that we assume is shown in (i). In this rule schema 'X' and 'Y' range over, at least, [±N] (noun) and [±V] (verb) and the superscript ranges over levels of projections from zero to two (or more) (see discussion in Jackendoff, 1977; Muysken, 1983).

i) X^n: (Y^n. . . . .) X^{n-1} (Y^n. . . . .)

The item on the right-hand side of the rule which is of the same category as that on the left-hand side (i.e. X^{n-1}) is the 'head' of category X^n. X^n is called the 'projection' of the head. The projection that has the maximum value for n is the maximal projection of the head. The orientation of the 'head' with respect to its sisters is a parameter along which languages may vary. Languages can be head-final or head-initial.

The head-initial/head-final parameter is argued to constitute a principle of UG (Chomsky, 1981; 1982; 1984; forthcoming). The exact nature of this parameter is at issue both theoretically and empirically (Chomsky, forthcoming for a discussion). Researchers are approaching the issues involved in the precise formulation of this parameter in a variety of ways. Results of this work thus far suggest that a number of other formulations also cohere with or overlap with the presently proposed head-initial/head-final parameter, specifically the Principal Branching Direction (PBD) coherence in L1 acquisition (Lust, 1983; forthcoming). Other work and formulations which bear directly on this paramter can be found in the work of Travis, 1983; 1984: θ-direction, case direction; Koopman, forthcoming; Chomsky, 1964; Kayne, 1984: canonical government; Hoekstra, 1984: government direction.

Either the head-initial/head-final parameter or the PBD formulation can capture the relations at issue in this paper. The head-initial/head-final terminology has been chosen largely because of this phraseology is more standard in the field. Nonetheless, it is important to note that the two formulations as currently articulated do not account for the same set of language structures. PBD is defined over unmarked branching direction in sentential complement relations such as adverbial subordinate clauses, relative clauses, etc. (Lust and Magnione, 1983). The head-initial/head-final parameter, on the other hand, focuses primarily on crosscategorial phrase-internal relations (see above) and applies by implication rather than argument to adverbial subordinate clauses, for example. How these two formulations are to be integrated has yet to be determined.

[3] The precise formulation of this term and concept is under current theoretical and empirical investigation. Issues related to this work concern, for example, whether or not L2 learners actually revise L1 values or whether L2 learners generate a new parametric value such that learners have parameters set in two different ways. Work is now in preparation which seeks to answer these questions.

[4] The name initially used to describe this parameter was Principal Branching Direction (see Note 2 and Lust, 1983; forthcoming for a detailed discussion).

[5] In this paper we do not evaluate our hypotheses *vis à vis* head-direction with structures which instantiate a lexical category complement relation. Instead, we are concerned with the more general configuration as instantiated for example in an adverbial clause/main clause relationship (Comp-S, or SS′ structure) – a type of head-adjunct relationship. Pre- and postposing of an adjunct clause (a type of complement although in a more general sense than that traditionally used) in relation to a main clause (a type of head although also in a more general sense) involves both the ordering and the hierarchical structuring of a non-head element in relation to a head – the basic generalization captured by X-bar theory. We realize that this generalization is somewhat speculative as one of the two anonymous reviewers has pointed out. Adjunct clauses in contrast to complement clauses are not governed by the verb. They do not allow the possibility of extraction (Hale, p.c.; Huang, 1982). Most of the work on directionality within X-bar theory has been done at the X-bar level. There has been little work with adjunct clauses (X″ or perhaps X‴ level) (Smits, 1983). Nonetheless, we think that this

extension is reasonable for at least two reasons. First, as Huang (1982) argues Chinese is head-final at the highest levels of X-bar expansion, meaning at the X″ or X‴ level. Adjunct clauses are argued to be attached at just these levels. And second, it has already been empirically suggested that young children learning their L1s treat these adjunct clause structure as instantiations of a more general head-complement configuration (See Lust, 1983; forthcoming).

[6] For a discussion on the comprehension (act-out) results, see Flynn, 1983; forthcoming; and submitted.

[7] The shared property of head-finality is most clearly exemplified in the expansion of the NP in Chinese (Huang, 1982). Huang claims that VP, AP and PP require a head-final rule at the highest levels of X-bar expansion but a head-initial rule for these categories at the lowest level of expansion. This is to account for the fact that Chinese has, for example, prepositions, and will allow bare NPs or verbal complements to follow a verb. Huang's X-bar schema for Chinese is shown in (ii).

ii) $[X^{n-1}YP^*]$ iff $n = 1$ and $X \neq n$
$[YP\ X^{n-1}]$ otherwise (Huang, 1982: 41)

[8] The results in Table 1, suggest that the Chinese did slightly better on these sentence structures than did the Japanese. Results of analysis of covariance (see Flynn, 1983a; forthcoming; submitted and Kerlinger and Pedhazur, 1973 for a discussion of covariance) indicate a significant overall difference between the two groups in terms of amount correct on sentences without pronoun anaphors. (Language Group (Chinese, Japanese) × Language Level (low, mid, high) × Sentence Structure (pre- or postposing) $F(1,106) = 14.55$, $p = .002$.) Further means analyses indicate that the source of this significant effect is at the advanced level, $F(1,48) = 12.67$, $p = .0009$. There were no significant differences between the Japanese and the Chinese at the beginning or intermediate levels.

Results of an analysis of covariance on sentences with pronoun anaphors (Language Group (Chinese, Japanese) × Language Level (low, mid, high) × Direction of anaphora (forward, backward)) indicate no significant differences at any level between the two groups. We are now currently investigating in a set of studies (Flynn, C. Mitze, and K. Mitze, in progress) the contributions, if any, made by a match in properties associated with word order between Spanish and Chinese speakers learning ESL. That is, is there any contribution made by a match in either

expansion of the VP as head-initial at the lowest level of X-bar (in Huang's terms) or by a match in θ-role direction as right in Spanish, English and Chinese (in Travis's terms).

Essential to our argument here, however, is that the general patterns of results we have isolated in this study for the Chinese match those of the Japanese. To the extent that they do, our hypotheses are confirmed.

[9] Conversion to coordination refers to errors in which the S converted the subordinate/main clause structure to a coordinate sentence structure (with or without 'and') in which the two original clauses were maintained.

Example:
Stimulus: The man answered the boss when he installed the television.
Response: The man answered the boss (and) the man installed the television.

[10] The fact that Ss converted the preposed sentence structures to coordinate structures which involved some redundancy in the *subject* also suggests that these learners are reworking structural parameters n the direction of the L2. Coordinate sentence structures which involve *subject* redundancy involve a type of forward anaphora in terms of possible deletion patterns as in sentence (iii).

iii) *The man* questioned the lawyer and (*the man*) delivered the message.

[11] Anaphora errors refers to errors which involved some type of revision of the relation between an antecedent and a pronoun. This error was scored only on sentence imitations which maintained the basic two-clause structure (see Flynn, 1983a; forthcoming for a more detailed description of these errors.)

Example:
Stimulus: The man answered the boss when he installed the television.
Response: The man answered the boss when *the man*.

Appendix I Stimulus sentences

Preposed/No anaphora:

1) When the man dropped the television, the doctor called the child.
2) When the actor finished the book, the man called the professor.
3) When the owner finished the plans, the worker called the foreman.

Postposed/No anaphora:

1) The teacher answered the woman when the child entered the room.
2) The boss informed the man when the worker entered the office.
3) The worker called the man when the engineer finished the plans.

Preposed/Backward pronoun

1) When he entered the office, the janitor questioned the man.
2) When he delivered the message, the man questioned the lawyer.
3) When he prepared the breakfast, the doctor called the professor.

Postponed/Forward pronoun

1) The man anwered the boss when he installed the television.
2) The mayor questioned the president when he entered the room.
3) The man introduced the actor when he delivered the plans.

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